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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/931,493	08/16/2001	Maurice W. Peterson	99CR098/KE	3675

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Rockwell Collins, Inc.
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EXAMINER	
FILE, ERIN M	
ART UNIT	**PAPER NUMBER**
2634	

DATE MAILED: 04/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/931,493	PETERSON ET AL.
	Examiner	**Art Unit**
	Erin M. File	2634

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 3/10/2005.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Arguments

1. Applicant's arguments filed 3/10/2005 have been fully considered but they are not persuasive.

2. *Applicant's Argument:*

However, in disagreement with the assertions made in the Office Action it must be understood that Carney is also silent as to the calibration circuitry generating a Phase error estimate of the transmitter in any manner. Kafadar also does not provide any such teaching.

Examiner's Response:

The examiner admits that Carney fails to teach calibration circuitry generating a phase error estimate of the transmitter in any manner. However, Carney teaches a predistortion processor (fig. 1, 142) which provides the transmitter with a calibration signal. Kafadar teaches calibration circuitry which generates phase error estimate. Kafadar discloses a calibration method in which a number of samples of the data signal as in-phase and quadrature (IQ) pairs define a linearly transformed circle that includes, or envelops, the signal sample (abstract). The calibration is then performed as illustrated in figure 5C. Kafadar further discloses the relationship between the resultant calibrated point (x, y) can be expressed as a function of the sampled pair (I,Q) as:

$$\begin{bmatrix} x \\ y \end{bmatrix} = \rho \begin{bmatrix} \gamma & 0 \\ \sin\phi & \cos\phi \end{bmatrix} \begin{bmatrix} I \\ Q \end{bmatrix} + \begin{bmatrix} I_0 \\ Q_0 \end{bmatrix} + \begin{bmatrix} \epsilon_x \\ \epsilon_y \end{bmatrix}$$

Equation 1

Where:

γ equals the gain ratio between the I and Q channels;

φ equals the angular difference between ideal quadrature (90 degree) and actual quadrature;

ρ equals the scale factor;

I_o equals the DC offset in the I-channel;

Q_o equals the DC offset in the Q-channel; and

ε_x, ε_y are uncorrelated random errors in the measurement of the x and y coordinates (col. 4, lines 1-14)

The envelope can be thought of the general shape of the signal. The angular difference between the ideal quadrature and the actual quadrature can be though of as the phase error estimate as a function of the angular difference between the desired signal envelop and the actual envelop. In light of this equation of the calibration of this signal can be expressed in terms of the angular difference, or phase error, between the ideal and the sampled signal.

3. *Applicant's Argument:*

Carney is silent, however as to the use of phase error estimate of the transmitter as an input and providing as an output the transmitter input signal as a function of the phase error estimate.

Examiner's Response:

The examiner admits that Carney is silent as to the use of phase error estimate in the transmitter. However, Carney is not silent as to the use of a calibrating signal as input to a transmitter and a transmitter output that is a function of the received error. Carney's transmitter uses samples of distorted (fig. 1, 150) and undistorted signals (125) input to a predistortion processor (143) which creates a predistortion signal that is input to the transmitter, and the output transmitted signal is a function of this calibration signal. A predistortion signal that uses a phase error estimate is disclosed in Kafadar as described in paragraph 2 of this action.

4. *Applicant's Argument:*

However, Kafadar is also silent as to the use of predistortion circuitry that receives the source signal and uses a phase error estimate of the transmitter as an input, further providing as an output the transmitter input signal as a function of the phase error estimate, as required by claim 1 of the present invention.

Examiner's Response:

Kafadar is not silent as to use of an actual transmitted signal and a desired signal and the use of calibration process to determine the distortion parameters of the channel, as is described in the above equation in paragraph 2. Kafadar does not discuss the use of these determined parameters in terms of predistortion circuitry for a transmitter. However, Carney discloses a predistortion processor (fig. 1, 142) that receives both distorted (150) and undistorted (125) signals to generate predistortion calibration signal for the transmitter. Carney discloses a predistortion circuitry, but does not use the phase error estimate in determining the predistortion parameters. Kafadar discloses a calibration process on a received signal, but he does disclose a calibration procedure which determines distortion parameters in terms of a phase angle, as discussed in paragraph 2 above.

5. Applicant's Argument:

Carney and Kafadar fail to teach or suggest (1) that calibration circuitry generate a phase error estimate of the transmitter; (2) that the calibration circuitry generate the phase error estimate as a function of an angle of intersection between the desired transmitter envelope and an actual transmitter envelope; and (3) that predistortion circuitry provides the transmitter output as a function of the phase error estimate of the transmitter. Lacking any one of these claim requirement prevents a combination of Carney and Kafadar from rendering claim 1 obvious.

Examiner's Response:

(1) Kafadar does provide calibration circuitry generate a phase error estimate as is described in paragraph 2 above. (2) Kafadar discloses calibration circuitry generate the

phase error estimate as a function of an angle of intersection between the desired transmitter envelope and an actual transmitter envelope as is described in paragraph 2 above. (3) Carney discloses predistortion circuitry provides the transmitter output as is explained in paragraph 3 of this document. Kafadar discloses the determination of a function of the phase error estimate as is described in paragraph 2 above.

6. *Applicant's Argument:*

...both Carney and Kafadar are silent as to predistortion circuitry receiving at least one of a calibration circuitry generated phase error estimate, gain error estimate, or dc offset estimate as inputs and providing as an output the transmitter input signal as a function of the at least on: of the calibration circuitry generated phase error estimate, the gain error estimates and the dc offset estimate...

Examiner's Response:

Carney discloses calibration circuitry as expressed in paragraph 3 of this action. Carney does fail to disclose calibration circuitry which uses at lease one of phase error estimate, the gain error estimates and the dc offset estimate. However, Kafadar discloses a calibration method in which both the angular difference, or phase estimate and the DC offsets are determined and input as calibration data to the transmitter. See paragraph 2 of this document, equation 1 for more details of Kafadar' disclosed method.

DETAILED ACTION

Claim Rejections – 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-20 are rejected under U.S.C. 103(a) as being unpatentable over Carney et al. in view of Kafadar et al.

Claims 1, 10, 15, Carney discloses a distortion correction technique comprising:

- Digital transmitter (figure 1, 16) that receives a clock signal and local oscillator signals (163, 164) to provide a broadband transmission signal
- Calibration circuitry (figure 1, 12) coupled to the transmitter which receives a correction signal from the predistortion processor and source signals (121) to generate an error estimate of the transmitter
- Predistortion circuitry (figure 1, 14) coupled to the signal source (121), the transmitter (16) and the calibration circuitry (12). The predistortion circuitry receives the source signal (121) and uses the phase error estimate of the

transmitter as an input and provides as an output the transmitter input signal as a function of the error estimate.

Carney fails to disclose generating a phase error estimate of the transmitter as a function of an angle of intersection between a desired transmitter envelope and an actual transmitter envelope. Carney also does not disclose a quadrature compensation system. However Kafadar teaches Phase-Shift Keying (PSK) modulation system having a quadrature calibration of a vector demodulator using a statistical approach for analysis and correction of received data. Kafadar teaches calibration circuitry which generates phase error estimate. Kafadar discloses a calibration method in which a number of samples of the data signal as in-phase and quadrature (IQ) pairs define a linearly transformed circle that includes, or envelops, the signal sample (abstract). The equation which Kafadar uses for his calibration method is found in paragraph 2, equation 1 of this document. In this relation each vector defined by an (I,Q) pair in a received data signal to define a linearly transformed circle (col. 2, lines 18-26). These parameters determine calibration factors employed to adjust the received information (col. 23, lines 29-33). It would be obvious to one skilled in the art at the time of invention to incorporate Kafadar's calibration teachings into Carney's modulator correction system because PSK is an efficient modulation scheme for digital transmission.

Claims 2, 11, inherit the limitations of Claims 1, 10 respectively. Kafadar discloses in his calibration equation (eq. 1) the DC gain, or gain error in the in-phase and quadrature

channels. The in phase and quadrature gains can be easily manipulated as gain = $\mathrm{sqrt}(I_o^2+Q_o^2)$.

Claim 3, 12, inherits the limitations of claim 2. Further Kafadar teaches a vector demodulator where a statistical approach is used for the analysis and correction of received data. This circuit uses measurements taken from transmitted signals to determine semi-major and semi-minor axes of ellipses of waveforms (fig 5B, 112, 116) and uses these parameters to calibrate a demodulator. The ellipse defined by the measured points can be characterized by five parameters, the coordinates of the center E of the ellipse, the ratio of the lengths of the principal axes (fig 3, 22, 24) for the ellipse, the angle theta between the two principal axes, and the length of the major axis (22), which is related to the magnitude of the vectors defined by the points.

Claim 4, 16, inherits the limitations of Claim 3. Kafadar further discloses that the calibration process determines the center of the ellipse (fig. 5C, 120, 121).

Claim 5, inherits the limitations of Claim 4, further Kafadar teaches estimation and adjustment of the gain of in-phase and quadrature channels in (fig 5C, 122, 123).

Claim 6, 17, inherits the limitations of Claim 5. Kafadar further discloses in equation 1 (col. 4, line 1) given in paragraph 2 of this document. In this equation for the calibration

of a signal, Kafadar discloses I_0 as the DC offset in the I-channel and Q_0 as the DC offset in the Q-channel.

Claim 7, inherits the limitations of Claim 1, Kafadar further discloses the use of each vector defined by an In-phase and Quadrature (IQ) pair in a received data signal to define a linearly transformed circle (col. 2, lines 18-26) of the signal, which that is calibrated to be centered at (0,0) (figure 5C, 120, 121).

Claim 8, inherits the limitations of Claim 7. Kafadar further discloses in equation 1 (col. 4, line 1) given in paragraph 2 of this document. In this equation for the calibration of a signal, Kafadar discloses I_0 as the DC offset in the I-channel and Q_0 as the DC offset in the Q-channel.

Claim 9, inherits the limitations of Claim 8, Kafadar further discloses in equation 1 (col. 4, line 1) given in paragraph 2 of this document. In this equation for the calibration of a signal, Kafadar discloses I_0 as the DC offset in the I-channel and Q_0 as the DC offset in the Q-channel.

Claim 13, inherits the limitations of Claim 10. Kafadar further discloses that the calibration process determines the center of the ellipse (fig. 5C, 120, 121). Kafadar further discloses in equation 1 (col. 4, line 1) given in paragraph 2 of this document. In

this equation for the calibration of a signal, Kafadar discloses I_o as the DC offset in the I-channel and Q_o as the DC offset in the Q-channel.

Claim 14, inherits the limitations of Claim 13, further Kafadar discloses that the estimated DC offsets in the in-phase and quadrature channels are used in the calibration equation as described in paragraph 2, equation 1 of this document.

Claim 18, inherits the limitations of Claim 15. Further Kafadar teaches a vector demodulator where a statistical approach is used for the analysis and correction of received data. This circuit uses measurements taken from transmitted signals to determine semi-major and semi-minor axes of ellipses of waveforms (fig 5B, 112, 116) and uses these parameters to calibrate a demodulator. The ellipse defined by the measured points can be characterized by five parameters, the coordinates of the center E of the ellipse, the ratio of the lengths of the principal axes (fig 3, 22, 24) for the ellipse, the angle theta between the two principal axes, and the length of the major axis (22), which is related to the magnitude of the vectors defined by the points.

Claim 19, inherits the limitations of Claim 15, Kafadar discloses a calibration circuitry equation which generates a dc offset estimate (see paragraph 2, eq. 1) which can be used to calculate the gain error estimate (as described in Claims 2, 11), therefore occurring sequentially.

Claim 20, inherits the limitations of Claim 15, Kafadar discloses a calibration circuitry equation which generates the phase error estimate and the dc offset estimate (see paragraph 2, eq. 1).

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erin M. File whose telephone number is (571)272-6040. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (571)272-3056. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Erin M. File

3/11/2005

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